Expanded Monitoring Program

Near Deer Trail, Colorado

Quarterly Report
January–March 2000

Volume 2, no. 1

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USGS

The U.S. Geological Survey is a science organization that provides the Nation with reliable, impartial information to describe and understand the Earth. The national USGS home page: http://www.usgs.gov

This USGS program:

Internet address for precipitation data at wells DTX2, D25, DTX5 (South Platte River Basin):
http://co.water.usgs.gov/rt-cgi/gen_tbl_pg_mt
or *http://nwis-colo.cr.usgs.gov/*

Internet address for quarterly reports:
http://co.water.usgs.gov/projects

Program Overview

Metro Wastewater Reclamation District (Metro District) applies biosolids to their properties near Deer Trail, Colorado. These biosolids applications could affect the quality of water in alluvial and bedrock aquifers, streambed sediments, soils, and crops. Water quality can be directly affected through:

- Contaminated recharge water, or
- Infiltration of water through contaminated soils or sediments (remobilization).

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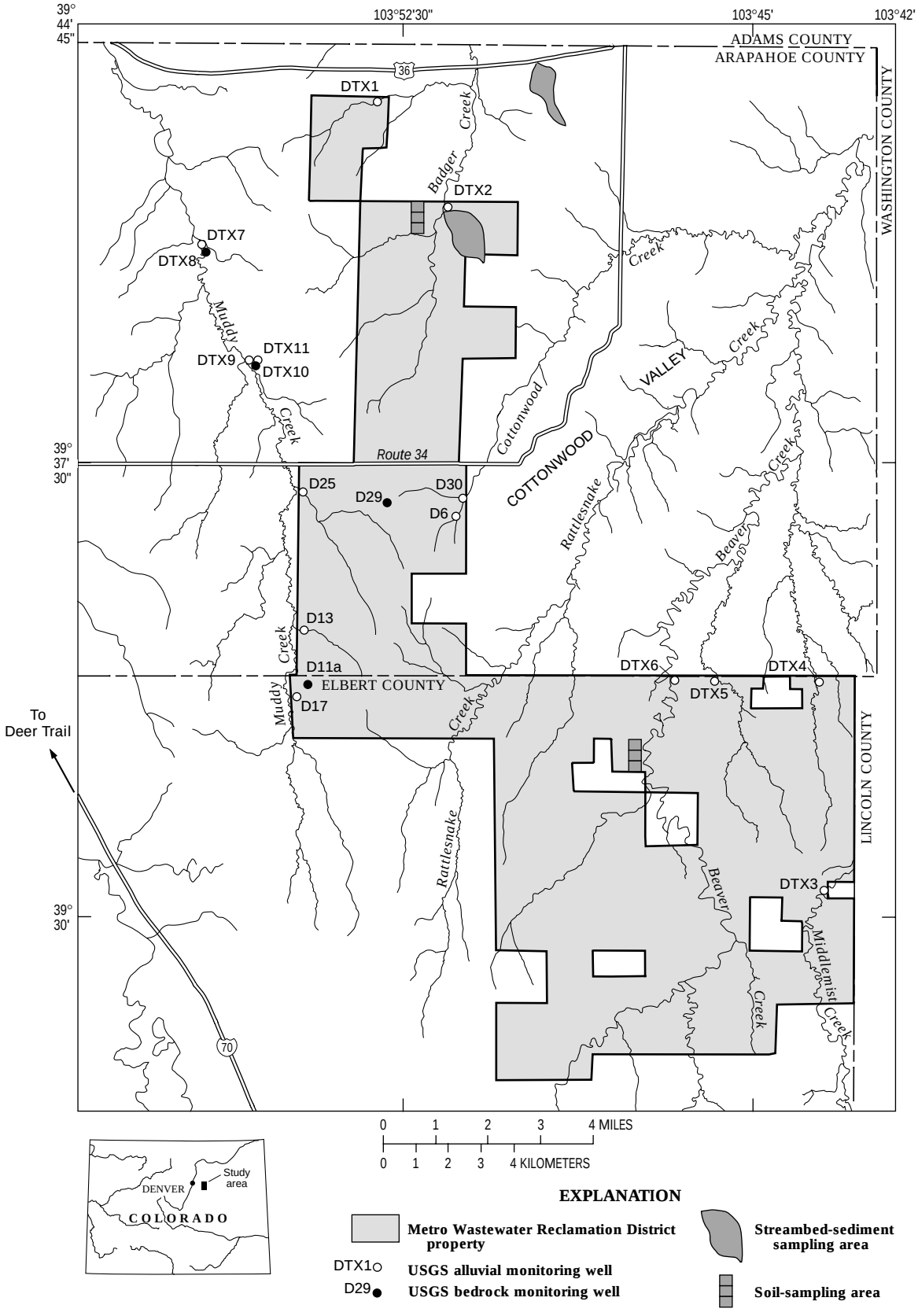
USGS drilled a new well in January 2000 to better evaluate interaction between the alluvial and bedrock aquifers. USGS Project Manager, Tracy Yager, described and sampled core during drilling. The new well is known as DTX11 and is located on the Weisensee property.



USGS Expanded Monitoring Program sites and Metro District's biosolids-application properties near Deer Trail, Colorado

Program Overview

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Water quality can be indirectly affected through:

- Plowing that mobilizes or changes subsurface chemical constituents, or
- Contributions to natural processes such as nitrification.

Contaminated ground water or surface water could contaminate:

- Other aquifers, such as bedrock water-supply aquifers or alluvial aquifers,
- Other surface-water bodies (ponds or streams), or
- Streambed sediments.

Biosolids must meet metals and radioactivity regulations, or else agronomic loading rates will be incorrect and soils could be overloaded. Soil quality could either be improved by biosolids applications through increased nutrients and organic matter, or degraded through an overload of nutrients or metals.

The U.S. Geological Survey (USGS) has designed and begun a new monitoring program to address concerns from a stakeholder group about the biosolids and the quality of the environment in the vicinity of the biosolids-application areas. The new USGS monitoring program near Deer Trail is referred to as the "USGS Expanded Monitoring Program" and began in January 1999.

This monitoring program is distinct from, but builds on, another USGS program that monitored shallow ground-water quality on the Metro District Central Farm from 1993-1998. The new program (1999-2005) considers environmental-quality issues for shallow and deep ground water, surface water (bed sediments), soils, crops, and the biosolids. The new expanded monitoring program includes all three Metro District properties (North, Central, and South Farms) and related private-property locations. Both programs, however, use USGS and Metro District funds. In addition, the new monitoring program also uses funds from the North Kiowa Bijou Ground Water Management District. Both programs are designed, carried out, and interpreted independently by USGS, and quality-assured USGS data and reports will be released to the public and the Metro District at the same time. By definition and design, all USGS monitoring programs are independent and unbiased.

The objectives of the new Expanded Monitoring Program are to: (1) Evaluate the combined effects of biosolids applications, land use, and natural processes on alluvial aquifers, the bedrock aquifer, streambed sediments, soils, and crops by comparing chemical data to

- State or Federal regulatory limits,
- Data from a site where biosolids are not applied (a control site), or
- Earlier data from the same site (trends).

(2) Monitor biosolids for metals and radioactivity, and compare the concentrations with regulatory limits. (3) Determine the aquifer hydrology in this area.

The approach is unique for each component of the Expanded Monitoring Program. However, appropriate USGS methods and technologies will be applied to each component.

Quarterly reports such as this one will be distributed to the stakeholders and other concerned people, as well as available to the general public on the internet (http://co.water.usgs.gov). Each quarterly report will summarize progress from the previous quarter and plans for the current quarter; chemical data will be included every other quarter. A USGS report will be prepared annually and made available after each year of the monitoring program: the reports will include data for that year, any interpretations for that year, and statistical analysis for the data to date. A comprehensive USGS report will be prepared and available after five years of monitoring that includes complete statistical analyses and interpretations. In addition, the USGS will meet with the stakeholders once a year to discuss the Expanded Monitoring Program results and to consider possible changes to the Expanded Monitoring Program.

Questions & Answers

Q: Why were streambed-sediment data in the last USGS Quarterly Report (Oct.-Dec. 1999) shown with units of picocuries per liter (pCi/L)?

A: The units for the streambed-sediment data were reported in error and should have been picocuries per gram (pCi/g), not per liter. The Internet version of that USGS Quarterly Report has been corrected accordingly. The numbers are correct as originally reported.

Q: Streambed-sediment data were reported in the last USGS Quarterly Report for the biosolids site. Why were no data reported for the control (no biosolids applications) site?

A: USGS intended to collect streambed-sediment (from runoff) at both sites after the same storm, but found no evidence of streambed sediments deposited by runoff at the control site, so no sample could be collected. In future, a sample will be collected from both the biosolids and control sites after the same storm if evidence of runoff.

Alluvial Ground Water

Approach

Six new monitoring wells will be installed near the Metro District property boundaries in the major alluvial aquifers. These six wells plus five existing USGS monitoring wells will be sampled approximately quarterly for full inorganic chemistry and annually for radioactivity. Data will be reviewed and statistically tested for exceedance of regulations and trends.

Progress Last Quarter (January--March 2000)

Ground-water levels were measured January 12, February 4, and March 3, 2000. Ground water was sampled for chemistry (including radionuclides) January 6-13, 2000. Calibrations and checks at the 3 instrumented sites continued. Data from these 3 sites (DTX2, D25, DTX5) can be viewed on the Internet (*http://nwis-colo.cr.usgs.gov/)*. Ground-water data were compiled, reviewed, and released in the previous Quarterly Report in March 2000. Parts of the annual report were compiled and written.

Plans for the Current Quarter (April-June 2000)

Ground-water levels will be measured the first week of each month. Ground water will be sampled in early April, weather permitting. Rain gages will be calibrated. USGS will have a public meeting (held May 4 in Kiowa) to discuss the data and the monitoring program. Data will be compiled and reviewed. The annual report will be completed.

Bedrock Ground Water

Approach

A structure map of the base of the bedrock aquifer will be compiled and used to determine locations for two sets of new, clustered wells (one or two alluvial wells and one nearby dual-completion bedrock well comprise each cluster). The well clusters will be installed where both the Muddy Creek alluvial aquifer and the Laramie-Fox Hills aquifer are present (along the margin of the bedrock aquifer) near the Metro District properties. One site will continuously record water levels and precipitation at the well cluster and have two alluvial wells screened at different lithologies. Water-level data from each well cluster will be used to determine aquifer hydrology and interaction at those two locations. The two new bedrock wells, along with an existing USGS bedrock well, will be sampled approximately quarterly for full inorganic chemistry and annually for radioactivity. Data will be reviewed and statistically tested for exceedance of regulations and trends. The alluvial wells that are part of these well clusters will not be sampled.

Progress Last Quarter (January-March 2000)

Ground-water levels were measured January 12, February 4, and March 3, 2000. Ground water was sampled for chemistry (including radionuclides) January 6-13, 2000. An additional alluvial well, DTX11, was installed January 2000 at one of the bedrock well clusters to further evaluate aquifer interaction. Ground-water data were compiled, reviewed, and released in the previous Quarterly Report in March 2000. Parts of the annual report were compiled and written.

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USGS washes out the inside of the trucks used for ground-water sampling before packing them with clean sampling supplies. Dirt and dust inside the trucks can contaminate the trace-element samples.

Bedrock Ground Water

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Plans for the Current Quarter (April-June 1999)

Ground-water levels will be measured the first week of each month. Ground-water sampling will take place in early April, weather permitting. Continuous recorder instrumentation will be installed at the bedrock well cluster with the new well to further evaluate recharge. USGS will have a public meeting (held May 4 in Kiowa) to discuss the USGS data and monitoring program. Data will be compiled and reviewed. The annual report will be completed.

Tracy Yager and Cecil Slaughter of USGS attended the tour of the new onsite water treatment plant at the Lowry Landfill Superfund Site on March 1, 2000

USGS prepared ("developed") the new well, DTX11, by surging, bailing, and pumping to remove the fine particles from the well

The new Lowry water treatment plant includes many valves and a sampler (far right) for monitoring the treated water

Surface-Water Sediments

Approach

Surface-water contamination is a concern for the stakeholders, but streams flow off the Metro District properties only during runoff when surface-water sampling is impractical. Therefore, possible surface-water contamination from metals will be evaluated by sampling streambed sediments soon after storms. Two small drainage basins will be selected for similar characteristics but different land use—one drainage in a biosolids-application field and another drainage in a farmed field (not on the Metro District properties) that does not receive biosolids. A downstream location in each of the two drainage basins

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Surface-Water Sediments

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will be sampled after the same storms, three to four times per year for inorganic constituents (including metals, total nitrogen, and total phosphorous) and organic carbon, and one time per year for radioactive constituents. Data will be reviewed and statistically tested to determine if concentrations are significantly different between the two drainage basins.

Progress Last Quarter (January-March 2000)

The site was carefully monitored for runoff-producing precipitation, but precipitation was insufficient to produce runoff needed for sampling. Data were compiled, reviewed, and released in the previous Quarterly Report in March 2000.

Plans for Current Quarter (April-June 2000)

USGS will have a public meeting (held May 4 in Kiowa) to discuss the USGS data and monitoring program. Data will be compiled and reviewed. Sampling may take place, depending on the weather. USGS will check the continuously recording rain gage for accuracy, and will monitor the site for runoff-producing precipitation. The annual report will be completed.

Biosolids

Approach

Biosolids samples will be taken as a 24-hour composite from the Metro District plant and analyzed by USGS. Biosolids will be sampled and analyzed once each quarter during most of the program, and once each month for six months when the Lowry Landfill Superfund Site water transfer begins. Data will be reviewed and compared to Federal regulatory limits.

Progress Last Quarter (January-March 2000)

The quarterly composite sample of biosolids was received from the Metro District March 27, 2000. The sample was a 24-hour composite from the conveyor belt at the Metro facility. The material was placed in two acid-washed, one-gallon plastic bottles and transported to the USGS in Lakewood. There, the sample was air-dried prior to grinding to less than 150 micrometers. Chemical analyses of the De-

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On January 20, 2000, USGS presented the overview and first-year progress of the Expanded Monitoring Program near Deer Trail, Colo., to the Farm Committee of the Metro Wastewater Reclamation District Board of Directors

Biosolids

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cember 1999 biosolids sample were completed. Biosolids data were compiled, reviewed, and released in the previous Quarterly Report in March 2000. Parts of the annual report were compiled and written.

Plans for Current Quarter (April-June 1999)

The March biosolids sample will be submitted to the USGS labs for chemical analysis. The next quarterly sample of biosolids will be collected, dried, and prepared for analysis. USGS will have a public meeting (held May 4 in Kiowa) to discuss the USGS data and monitoring program. Data will be compiled and reviewed. The annual report will be completed.

USGS uses a different submersible pump for well development than for sampling because the sand particles moving through the well during development can ruin the sampling pump

Soils

Approach

One site will be selected for characterizing and monitoring the chemical composition of soil on the Metro District property in Arapahoe County and one site will be selected on the Metro District property in Elbert County. Each site will consist of three 20-acre (933 feet by 933 feet) fields separated by 100-foot buffer zones. The center 20-acre field at each site will have biosolids applied after the initial soil sampling. The other two 20-acre fields at each site will not have biosolids applied and will be used as "control" fields to monitor the natural variability of soil composition for the duration of the study. All three 20-acre fields at each site will be farmed in the normal fashion and have crops planted and harvested. Soils from each of the six fields will be sampled before biosolids are applied to the two center fields and then again after each harvest. Samples will be analyzed for arsenic, cadmium, copper, lead, mercury, molybdenum, nickel, selenium, zinc, plutonium, and gross alpha and beta activity. Data will be examined after 5 years to determine if concentration has changed with time.

Progress Last Quarter (January-March 2000)

Chemical analyses of the August soil samples were completed. Parts of the annual report were compiled and written.

Plans for Current Quarter (April-June 2000)

Pre-biosolids soil data were compiled and reviewed. USGS will have a public meeting (held May 4 in Kiowa) to discuss the USGS data and monitoring program.

Crops

Approach

Crops from each of the six 20-acre (soil monitoring) fields will be chemically analyzed after harvest. Analyses will include arsenic, cadmium, chromium, copper, lead, mercury, molybdenum, nickel, selenium, and zinc.

Progress Last Quarter (July-September 1999)

No field activity scheduled until harvesting of the first crop grown on the soil-monitoring fields in 2000. Parts of the annual report were compiled and written.

Plans for Current Quarter (October-December 1999)

No field activity scheduled until harvesting of the first crop grown on the soil-monitoring fields in 2000. The annual report will be completed.

Contact Mary Sue Liss (see page 8) to get on the mailing list or have the mailing list corrected

If you have questions about the Expanded Monitoring Program, please contact Tracy Yager (see page 8). Commonly asked questions will be included in each Quarterly Report.

Definitions

Alluvial aquifer—Unconsolidated (uncemented) sediments and gravels in current or historic stream channels or floodplains that contain significant amounts of ground water.

Bedrock aquifer—Water contained in the fractures or pore spaces of the rock that underlies soil or other uncemented materials.

Biosolids—Solid organic matter recovered from a sewage-treatment process that meets regulatory criteria for beneficial use, such as for fertilizer. Metro District applies Grade I, Class B biosolids at Deer Trail. Regulations require that land-applied biosolids must meet or exceed Grade II, Class B. Grade I exceeds Grade II.

Core—The soils and rock removed intact in a tube from the borehole when drilling a well.

Radionuclides—A radioactive atom characterized by a given number of neutrons and protons in its nucleus. For example, plutonium concentrations include plutonium-238 or plutonium-239, which are specific isotopes.

Stakeholder–Any person or group (including the Metro District) interested in or concerned about the Expanded Monitoring Program.

Well development—The process of forcing air or water in and out of the well screen (and the sand pack around the screen) to remove drilling fluids and particulates left from drilling a well that can affect the use of the well.

Contacts

USGS: Tracy Yager, 303-236-4882, ext. 225 (*email:* tjyager@usgs.gov)
Dave Smith, 303-236-1849
Jim Crock, 303-236-2452

Metro District: Duane Humble, 303-286-3267
(email: DHumble@mwrd.dst.co.us)

Elbert County: Mary Sue Liss, 303-621-3144
(email: elconurse@bewellnet.com)

State Biosolids Coordinator: Lori Tucker, 303-692-3613

U.S. Environmental Protection Agency: Bob Brobst, 303-312-6129

Next annual stakeholder meeting is being planned for September 2000, in Kiowa, Colorado. Call Tracy Yager or Mary Sue Liss for more information.

Prepared by Tracy Yager and Dave Smith, May 2000, in cooperation with Metro Wastewater Reclamation District

Tracy Yager
U.S. Geological Survey
Box 25046, MS 415, DFC
Denver, CO 80225-0046